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Original Article

Opinion on open-science practices and the importance of scientists' information literacy skills in context of open science at the University of Rijeka, Croatia – a cross-sectional study

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Abstract

Background: Although opinions of scientists about open access and the importance of their skills in information literacy have been investigated earlier but not, to our knowledge, of those in Croatia.

Objective: The objective was to analyse the opinions on open access and on open-science practices before implementing open-science policies.

Methods: Scientists at the University of Rijeka (N=1256) were invited to complete, anonymously, an online questionnaire on open science (Google Forms) in 2020 and their responses were analysed.

Results: Altogether 192 participants (a response rate 15%) were involved in this study, of which 110 (57%) were women. The mean age of the participants was 42 years (standard deviation 11). The participants pursued careers in biomedical (37%), social (31%), or technical (14%) sciences; 20% were early-career researchers or postdoctoral researchers, and 80% held the rank of assistant professor or higher. Most of them (88%) agreed that journals should be open access and 77% said they would choose the open-access journal if they had to choose between two journals with similar impact factors. Most (83%) considered publishing fees (article processing charges) to be too high; fewer than half (45%) considered the impact factor to be more important than open access; and 28% believed open access journals to be of lower quality. Nearly three-fourths (74%) had published at least one article in an open access journal, and 45%, without paying any fee. Only a few (10.9%) archived their articles in institutional or national repositories; more than a quarter (27%), on their web pages; and close to half (43%), on their social networks. To obtain papers not available to read online, more than half (56%) used Sci-Hub; slightly more than half (51%) wrote to the authors; 40% asked colleagues for help; and 35% approached a librarian.

Conclusions: Most of the scientists in our study were in favour of open access but considered the publication fees to be too high. Their archiving was inadequate: few used any institutional or national repositories. Therefore, the scientists need to be more information literate and require guidance and help from librarians and will benefit from training in information literacy including the principles of open access.

Keywords:

Archiving, attitude, information literacy, librarian, open access, open science, opinion, questionnaire, science, scientists, social media, tool

Introduction

Over the past 30 years, the boundaries between formal and informal communication in science have become increasingly blurred or have nearly disappeared, largely because of developments in information and communication technologies; as a result, the academic and publishing landscape has changed significantly. One of the changes was the emergence of open access (OA) as a new publishing model.[1] The first initiative advocating OA was launched in Budapest in 2002[2] and proposed two strategies, namely self-archiving and publishing in OA journals. Croatia has its separate declaration on OA,[3] and all journals financed by the state must publish all their content OA (https://hrcak.srce.hr/en). One of the first Croatian institutions that recognized the importance of OA initiatives with a declaration of open science and later with recommendations on open-science practices was the University of Rijeka.[4]

Self-archiving allows authors to deposit an authorized version of their paper in an institutional (national) or thematic repository.[5] Authors can also deposit papers on social media such as ResearchGate or Academia, whereas only a few of a sample comprising 210 scientific papers published between 2017 and 2019 by authors at the University of Rijeka were archived by them in their institutional repositories.[5]

With the promotion of OA and more accessible scientific content, the publishing industry exploded with a large number of OA publishers and journals[6] with even higher profits:[7] the former is a blessing for authors because it offers authors a wider choice of media through which to disseminate the findings of research; the latter is a bane, given the high article processing charges (APCs) charged by some journals and publishers.[8,9]

The criteria that authors consider while choosing a journal in which to publish include the quality and excellence of the publisher and of the journal, extent of its contribution to advancement of the domain, time taken to decide the fate of the submission, OA, APCs, Altmetrics score, use of open-science tools, and visibility in social media.[1,6] For advancement in career or for their contribution to be considered significant, authors in Croatia are required to (a) publish in journals covered by Scopus or the Web of Science or (b) publish in the first- and second-quartile journals (Q1–Q2) in biomedicine, (c) be the first or the last author or, in the social sciences, the only author or, also in the social sciences, and/or (d) publish in Croatian. Therefore, authors have to be not only skilled scientists and writers but also information literate enough to navigate these complex requirements. The Association of College and Research Libraries has recently defined information literacy (IL) as 'the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning'.[10] A qualitative study of IL by Croatian law scholars shows that the definition is similar to their understanding of the concept as it includes assessment, evaluation, and use of relevant sources of information.[11] Finding and evaluating an OA journal, archiving content, being present in social media, and using computer tools to promote an article are all IL skills that are becoming standard open-science practice for scientists.[12]

Open access has not only greatly influenced scientific communication but also

highlighted the need to develop additional information skills to help in choosing the most appropriate method of publication, to understand the complex landscape of scientific publishing, to take advantage of all the potential benefits of publishing, and to make scientific outputs more visible. Although researchers are aware of OA as a form of scientific publishing, many are not fully aware of all the possibilities that OA provides. The results of several studies have shown that some researchers do not know enough about OA and that the levels of IL skills in the academic community differ and are sometimes inadequate.[13,14] More specifically, a survey of 49 Croatian academic libraries showed that one-fifth of them do not educate their users on OA.[15]

Many researchers have investigated OA and IL skills of researchers, but not in Croatia: the IL skills and OA experiences of Croatian researchers remain to be assessed – and the present study attempts to bridge that gap by focusing on scientists from the University of Rijeka.

Methods

Participants and procedure

A total of 1256 scientists from the University of Rijeka, Croatia, were invited to complete, anonymously, an online questionnaire on open science (Google Forms) in 2020. The survey was open from 12 May to 7 July 2020, and the scientists were reminded to take the survey by sending them two reminders, the second following 14 days after the first.

Questionnaire

The questionnaire consisted of opinion questions on OA (8 items) and on self-reported open-science practices (20 items), together with demography-related questions (8 items); these questions were part of a larger questionnaire measuring attitudes towards open science. The analysis of open peer review, open data, and preprints has been published separately and was based on a larger sample.[16] The demography-related questions included those aimed at finding out the participants' gender, age, scientific field, roles in science, and the number of published papers. Response to questions seeking opinions was sought on a five-point Likert-type scale as follows: 1, strongly disagree; 2, disagree; 3, neither agree nor disagree; 4, agree; and 5, strongly agree. Questions related to self-reported open-science practice required either a Yes/No response or choosing one from multiple responses.

Statistical analysis

Qualitative data were presented as frequencies and relative frequencies and were subjected to the χ^2 test. Quantitative data were presented as means (standard deviation [SD]) or medians (interquartile range). The data were analysed with an open-source statistical program, namely JASP ver. 15.0 (JASP Team 2022).

Ethics

The study was approved by the ethical committee of the University of Rijeka (KLASA: 003-08/19-01/1; URBROJ: 217 0-24-04-3 -19 -7). The invitation to participate in the survey also included a consent form through which the participants were required to give their consent to their responses being recorded and used as data.

Results

Participants

A total of 192 scientists participated in the present study (a response rate of 15%) (Table 1). More than half (57%) of the

Table 1. Demographics of the participants (n=192)

Variable	n (%) or $M \pm$ SD
Gender	
Men	73 (38)
Women	110 (57)
Prefer not to say	9 (5)
Age (M±SD)	42 ± 11
Scientific field	
Biomedicine and health	71 (37)
Biotechnical sciences	2 (1)
Social sciences	60 (31)
Humanities	8 (4)
Interdisciplinary fields of science	8 (4)
Natural sciences	16 (8)
Technical sciences	27 (14)
Position in academia or science	
Research fellow	26 (13)
Postdoctoral researcher	14 (7)
Assistant professor or scientific associate	52 (27)
Associate professor or higher scientific associate	42 (22)
Full professor or scientific advisor	36 (19)
Other	22 (11)
Role[a]	
Project associate	155 (81)
Project leader	85 (44)
Reviewer for a scientific journal	122 (63)
Reviewer of scientific projects	50 (26)
Member of the editorial board of a scientific journal	66 (34)
Editor of a scientific journal	26 (13)
Faculty management	11 (6)

Due to rounding, percentages do not always sum to 100.
[a]Respondents could select more than one role.

participants were women, and the average age of the participants was 42 years (SD 11). A little over a third (37%) were engaged in biomedicine; 31%, in the social sciences; and 14%, in the technical sciences. Early-career researchers accounted for 20% of the participants, whereas the rest comprised those holding the rank of an assistant professor or higher. Almost three-quarters of the participants (142; 74%) had published at least one article in an OA journal, 64 (45%) of them without paying any fee or APCs. If paid, these charges were most often covered by project funds and institutions for 74 out of 102 scientists, although the remaining 38 used their personal funds for the purpose.

Opinions on open access

Most of the participants (88%) agreed that journals should be OA, and 77% said they would choose the OA journal if they had to choose between two journals with similar impact factors (Table 2). One-quarter of the participants (25.5%) considered OA to be more important than the impact factor while choosing a journal in which to publish their manuscript. Although a large majority (83%) considered publishing fees to be too high, more than a quarter (28%) yet believed OA

Table 2. Opinions on open access journals (n=192)

Statement	Strongly disagree, *n* (%)	Disagree, *n* (%)	Neither agree nor disagree, *n* (%)	Agree, *n* (%)	Strongly agree, *n* (%)
1. All scientific journals should be open access.	2 (1.0)	3 (1.5)	15 (7.6)	52 (26.5)	120 (61.2)
2. Among two journals with the same impact factor, I would choose the open access one.	7 (3.6)	6 (3.1)	25 (12.7)	32 (16.3)	121 (61.7)
3. When choosing a journal for publication, open access is more important than the impact factor of the journal.	38 (19.4)	50 (25.5)	53 (27.0)	31 (15.8)	19 (9.7)
4. I publish in journals in my field regardless of whether or not they are open access.	6 (3.1)	12 (6.1)	44 (22.4)	54 (27.6)	75 (38.3)
5. The fees (article processing charges) in journals are too high.	4 (2.0)	5 (2.6)	19 (9.7)	39 (19.9)	124 (63.3)
6. Papers resulting from publicly funded research should be published only in open access journals.	8 (4.1)	5 (2.6)	28 (14.3)	31 (15.8)	119 (60.7)
7. Closed-access journals are of better quality.	33 (16.8)	45 (22.9)	58 (29.6)	40 (20.4)	15 (7.6)
8. It is hard to find a free open access journal in my area.	14 (7.1)	27 (13.8)	67 (34.2)	47 (24.0)	36 (18.4)

journals to be of low quality. Three-quarters (76%) of the participants maintained that products of research funded by public bodies should be published in OA journals. Finally, 42% found it difficult to locate and select an appropriate OA journal.

We also checked whether the responses reflected any gender differences but found none ($p > 0.05$), except those to the question 'It is hard to find a free open access journals in my area' ($p = 0.012$): whereas 25% of the women found it harder to find an OA journal; the corresponding figure for men was only 17%.

Self-reported open-science practices

Archiving

Most of the participants (94.3%) archived their work themselves: only 18.2% sought the help of others, such as librarians (Table 3). Almost everyone archived some version or the other of their manuscripts, the version accepted for publication being the choice of 32.2%. Croatian scientific bibliography was the most popular archiving method (chosen by 70%), followed by social networks (43%) and individual scientists' web pages (27%) (Table 3).

The participants used different strategies to obtain papers published in journals that were behind a paywall: 56% used Sci-Hub; a little more than half (51%) wrote to the authors; 40% sought help from colleagues; and 35% approached a librarian.

Use of open-science tools and social networks for scientific purposes

A large majority (65%) used open-science tools and 75% used social media for scientific purposes (Table 4). As for open-science tools, 57% of participants used translation tools, 64% used sharing tools (64%, DropBox; 58%, Google Drive); 51% used the image manipulation program Gimp (51%); and 31% used Open Office. ResearchGate was the most popular

Table 3. Archiving of manuscripts and scientific papers (*n*=192)

Question	*n* (%)
Who is archiving your work?	
I, myself	181 (94.3)
Other people: librarians, assistants, administrative staff	35 (18.2)
What version of the manuscript or paper do you archive?[a]	
Manuscript before sending it for publication	38 (19.8)
Manuscript accepted for publication	42 (21.9)
Published work at the time of publication	62 (32.2)
Published work after publication following the terms of the journal	36 (18.7)
All versions	59 (30.7)
I do not archive	3 (1.6)
I archive my published papers in:[a]	
Institutional digital repository	21 (10.9)
Subject-specific digital repository	7 (3.6)
Own website	51 (26.6)
On social media	83 (43.2)
In Croatian scientific bibliography (CROSBI)	134 (69.8)
On my computer	11 (5.7)

[a]Participants could choose multiple answers.

choice (chosen by 69%) for sharing the work, followed by LinkedIn (41%), whereas Twitter was rarely used (6%).

Discussion

Scientists at the University of Rijeka recognize the importance of publishing in OA journals; 61% of the respondents in our survey maintained that all journals should be OA, and 60% agreed that research funded by public bodies should be published in OA journals only, which is consistent with Plan S, an initiative for OA publishing launched in 2018.[17] Also, 62% said that given a choice between two journals with the same impact factor, they would prefer the OA journal for publishing their work. However, the self-reported archiving practices of the participants indicate lower IL skills as evident from their responses: two-thirds of the participants did not consult a librarian, and 43% archived their papers on social media whereas only 10.9% chose institutional repositories for the purpose. More than half (56%) of participants reported that they regularly use Sci-Hub to access papers behind paywalls, a finding that indicates poor skills in finding information and scant regard for copyright violation, which is worrying.

With the rise of OA as a new model in scholarly publishing, there is a pressing need among researchers to acquire additional IL skills.[11] Libraries of higher-education institutions should offer training in IL to scientists that includes content related to open science that the open-science environment demands.[11,15] Our aim in conducting this piece of research was to encourage discussion and increase awareness of the importance of OA and IL education among scientists from different scientific fields at the University of Rijeka. The emergence of digital technologies and global scientific communities has profoundly changed the landscape of higher education, and these changes have had a significant impact on the information needs and behaviour of researchers. Information literacy programmes covering topics of scientific communication and OA prepare researchers

Table 4. Use of open-science tools and social networks for scientific purposes

Question	*n* (%)
Do you use any of the open-science tools? (*n* = 189)	
Yes	127 (64.8)
No	62 (31.6)
Do you use social networks for scientific research purposes? (*n* = 192)	
Yes	146 (74.5)
No	46 (23.5)
If you use social networks, please mark the ones you use (*n* = 157):[a]	
Academia.edu	54 (28.1)
Facebook	48 (25.0)
LinkedIn	78 (40.6)
ResearchGate	133 (69.0)
Twitter	11 (5.7)
Reddit	1 (0.5)
Open-science tools:[a]	
DropBox	111 (64)
Gimp	98 (51)
Google Docs	30 (16)
Google Drive	112 (58)
Google Translate	109 (57)
Image J	18 (9)
JASP	8 (4)
LaTex	17 (9)
Open office	60 (31)
PSPP	6 (3)
Phyton	32 (17)
R	20 (10)
Zoom	96 (50)
Webex	34 (18)
Zotero	18 (9)

[a]Participants could choose multiple answers.

for the current dynamic scientific publishing environment.[18]

As to the limitations of the present study, one is that it was only a single-centre study, confined to only one university in Croatia, and therefore may not represent all Croatian universities, let alone those elsewhere in Europe. Secondly, the response rate was low, because the investigation was carried out in 2020 during the pandemic and the lockdown.

In conclusion, libraries of higher-education institutions have a major role in supporting all-round education by offering training in IL with particular reference to science publishing. Universities and libraries must, therefore, review and explore sustainable research support frameworks to better support researchers in the digital age. Based on the results of this study and on earlier research, we suggest that the topic of OA included in such training should cover the following facets:

- Journals in the participants' respective discipline or field, ranking of these journals, the type of research they publish;
- Different types of OA and their implications;

- The work of the journal in OA;
- OA policies for journal articles published as Gold OA and Green OA;
- Licenses and copyright (including Creative Commons) in connection with OA;
- Copyright and editorial policies of journals related to OA;
- Key quality indicators of OA journals;
- Benefits of archiving or auto-archiving in repositories; and
- Digital media to create and communicate research in the digital environment.

This study contributes to the somewhat limited literature offering theoretical and practical reflections on the importance of scientists' IL skills and their experiences with OA; opens the way to further research; and creates greater awareness of this topic. At a practical level, the research opens a discussion on the importance of creating and implementing OA IL programmes for scientists and promotes the position and role of libraries of higher education institutions in the academic environment.

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